Multiple Conditions Present at Death:

A SPECIAL STUDY

NORTH CAROLINA DEPARTMENT OF HUMAN RESOURCES
DIVISION OF HEALTH SERVICES – VITAL RECORDS BRANCH

CERTIFICATE OF DEATH

Registration District No. _____ Local No. _____

Type, or print in permanent black ink

DECEASED

1. Name of Deceased: First JOHN	Middle Q.	Last DOE	2. Sex M	3. Date of Death (Month, Day, Year) JULY 4, 1976	
4. Color or Race WHITE	5a. State of Birth (If not U.S.A. give country) N.C.	5b. County of Birth HOPE	6. Date of Birth JULY 4,1906	7. Age (In Years) (Last Birthday) 70	If under 1 year: Months / Days; If under 24 hours: Hours / Min.
8a. Place of Death-County HOPE	8b. City or Town UNIONTOWN	8c. Name of Hospital or Institution (If not in hospital, give street and number) HOPE GENERAL HOSPITAL	8d. If Hosp., or Inst. (Specify OPD, Emer. Rm., Inpatient, etc.) EMER RM	8e. Inside City Limits (Yes or No) YES	
9a. Residence - State N.C.	9b. County HOPE	9c. City or Town UNIONTOWN	9d. Street and Number or R.F.D. & Box No. 1 ELM STREET	9e. Inside City Limits (Yes or No) YES	
10. Citizen of What Country USA	11. Married, Never Married, Widowed, Divorced (Specify) WIDOWED	12. Surviving Spouse (If Wife, Give Maiden Name)			
13. Social Security Number 123-45-6789	14a. Usual Occupation (Kind of work done during most of life, even if retired) WEAVER	14b. Kind of Business or Industry TEXTILE	15. Was Decedent Ever in U.S. Armed Forces? (Yes or No) NO		

PARENTS

16. Father's Name	17. Mother's Maiden Name
18a. Informant's Name and Address	18b. Relation to Deceased

CAUSE

PART I. DEATH CAUSED BY: ENTER ONLY ONE CAUSE PER LINE FOR (a), (b), (c). — Approximate Interval Between Onset and Death

Conditions, if any which gave rise to immediate cause (a), stating the underlying cause last.

(a) Immediate Cause: CARDIAC ARREST

(b) Due to, or as a consequence of: MYOCARDIAL INFARCTION

19. (c) Due to, or as a consequence of: GENERALIZED ARTERIOSCLEROSIS

PART II. Other Significant Conditions Contributing to Death but not related to cause given in Part I(a).

20a. HYPERTENSION DIABETES MELLITUS

20b. Autopsy (Yes or No)	20c. If yes, were findings considered in determining cause of death	21. Was case referred to Medical Examiner (Yes or No)	22. Time of Death
YES	NO	NO	7:07 P.M.

NOTICE: STATE LAW REQUIRES THAT ALL DEATHS DUE TO TRAUMA, ACCIDENT, HOMICIDE, SUICIDE, OR UNDER SUSPICIOUS, UNUSUAL, OR UNNATURAL CIRCUMSTANCES BE REPORTED TO, AND CERTIFIED BY A MEDICAL EXAMINER ON A MEDICAL EXAMINER'S CERTIFICATE OF DEATH. ANY DEATHS FALLING INTO THESE CATEGORIES IS WITHIN THE MEDICAL EXAMINER'S JURISDICTION REGARDLESS OF THE LENGTH OF SURVIVAL FOLLOWING THE UNDERLYING INJURY.

CERTIFIER

23a. Name and Title of Certifier (Type or Print) HENRY ROE, MD	23b. Address 101 MAIN STREET UNIONTOWN, NC
Sign with permanent black ink. 23c. Signature of Certifier Henry Roe MD	23d. Date Signed JULY 5, 1976

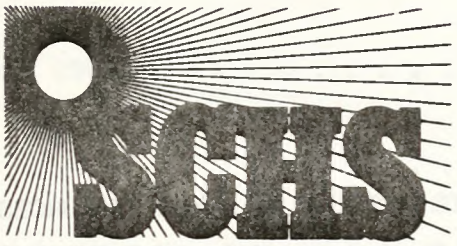
BURIAL

24a. Burial, Cremation, Other (Specify) BURIAL	24b. Date 7-7-76	24c. Name of Cemetery or Crematory MEMORIAL PARK	24d. Location (City, Town or County) (State) UNIONTOWN NC	
25. Funeral Home Name GRAY FUNERAL HOME	Address UNIONTOWN, NC	26. Signature of Funeral Director Thomas Poe	License No. 999	
27a. Date Rec'd by Local Reg. 7-14-76	27b. Signature of Registrar Max Moe	28. Signature of Embalmer (If Embalmed) Thomas Poe	License No. 999	

DHS 1872
FORM 8

State Center for Health Statistics
Division of Health Services
N.C. Department of Human Resources

MULTIPLE CONDITIONS PRESENT AT DEATH:
A SPECIAL STUDY



State Center For Health Statistics
(919) 733-4728

a supplement to

Leading Causes of Mortality

N.C. Vital Statistics, Volume 2

June 1982

STATE OF NORTH CAROLINA
James B. Hunt, Jr., Governor

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I. INTRODUCTION

Beginning in the 1976 edition of Leading Causes of Mortality (N.C. Vital Statistics, volume 2), tables showing the frequency of multiple conditions mentioned on the death certificate were included. Deaths have traditionally been tabulated by underlying cause of death only, and this may obscure other significant conditions present at and contributing to death. Crosstabulations of conditions mentioned by underlying cause and of conditions mentioned by conditions mentioned were included in volume 2 editions for 1976 (1975 and 1976 data) through 1978. Multiple conditions data for 1979 and 1980 were not included in the 1979 and 1980 abbreviated versions of Leading Causes of Mortality. Changes due to revisions in the International Classification of Diseases in 1979 and due to new population data from the 1980 census altered the format of those two volumes. The standard format for volume 2 will be resumed with the 1981 edition.

This special publication has several purposes. One is to "catch up" on the multiple conditions tabulations for 1979 and 1980. Another purpose is to explain some of the technology recently developed by the National Center for Health Statistics for handling multiple conditions data. Also, some trends in diseases reported on the death certificate are examined, since multiple conditions data back to 1969 have recently been made available to us by the National Center for Health Statistics. A major part of this report deals with trends from 1969 to 1978, all years under the 8th Revision of the International Classification of Diseases.

A note of caution should be added here concerning use of these multiple conditions data. At best this information would reflect morbidity among decedents, but this implies a completeness of reporting that is not actually present. The death certificate asks only for conditions "contributing to death," and so other diseases present at the time are not likely to be listed. It is therefore not entirely appropriate to refer to the "prevalence" of a certain disease at death when using information from death certificates. In addition, there may be substantial variations in the quality of medical certification that affect racial or geographic differences or trends over time. Nevertheless, we have chosen to use this

information to shed some light on diseases present at death, while keeping in mind its limitations.

The following background section will serve as preparation for the subsequent data analyses.

II. BACKGROUND

Conditions listed on the death certificate do give a picture of illnesses present among persons who die, but the degree of completeness of these data is unknown and, in any event, these data should not be considered to represent morbidity in the community at large. "Prevalence of a given condition at death is only a partial measure of the morbidity from that condition in the general population" (1). People who die tend to have more serious diseases and more disease combinations than sick people as a whole. The same general point has been made with regard to estimating morbidity based on the experience of hospitalized persons (2). But even though we are looking at a select group of people, examination of multiple conditions listed on the death certificate can help provide a better picture of the disease processes resulting in death and may suggest health problems that exist in the general population as well. Much information is lost in selecting a single condition as the underlying cause of death. "So long as the major public health problems primarily involved acute infective diseases, the concept of the principal or fundamental cause of death was quite adequate for the purpose of classifying causes of death"(3). With modernization, however, industrialized nations are increasingly characterized by mortality from chronic disease, and it has become increasingly difficult to describe each death by one and only one cause.

For years, nosologists have selected one condition from the death certificate as the "underlying" cause of death based on the rules of the World Health Organization. This has been the basis for most tabulations of death data. In 1968 the National Center for Health Statistics began entering all conditions mentioned on the death certificate into their computerized system, but until very recently these data were used almost exclusively in an automated system for selecting underlying causes of death (called ACME for Automated Classification of Medical Entities). Before 1968, the national coding of more than just a single underlying cause of death was undertaken in the United States only five times. Data from these special studies and from 1976, shown in Table 1, suggest an increasing prevalence of multiple conditions at the time of death. Though some of this increase may be due to better recording practices by physicians, it does

reflect the general trend of more deaths resulting from chronic disease combinations, which is associated in part with an aging of the U.S. population.

Table 1

Percent of Deaths in the United States with More than One Cause of Death Reported

Year	Percent
1976	74
1955	58
1940	55
1936	60
1925	44
1917	35

NOTE: Table is taken from Reference (3).
Nature of injury codes are excluded.

The development of the ACME system for selecting underlying cause of death paved the way for examination of multiple causes of death. Since all conditions recorded on the death certificate were coded for computer use, other types of analysis of these conditions became possible. The North Carolina State Center for Health Statistics began in 1975 counting the frequency of selected mentioned conditions and combinations using these data, though extensive recoding and reformatting were required to use the data designed for ACME. Improvements in the ACME program in 1979, with introduction of the 9th revision of the International Classification of Diseases, made these multiple cause data easier to use. But the intent still was to reflect conditions exactly as they were recorded on the death certificate.

To improve the analysis of multiple cause of death data, the National Center for Health Statistics developed in 1979 and 1980 a computer system called TRANSAX, for Translation of Axis (4). This system has been applied to mortality data for the years 1968 to the present. The idea was

to translate the basis of the death coding from an "entity" axis to a "record" axis. Rather than reflecting conditions in the exact manner given by the certifier, the record axis results from applying the international linkage rules to the secondary conditions themselves (as well as using linkage rules to select underlying cause). The intent is to consider the record as a whole and classify the most meaningful set of conditions to describe a death. Redundant and contradictory codes are eliminated and some new codes are generated from specified combinations. Only about 15 percent of the death records are modified by the TRANSAX process, but the result is a more accurate and concise portrayal of multiple conditions present at death, though there may be some loss of detail.

To count decedents with conditions, rather than conditions recorded, it is most appropriate to use this modified set of record axis codes. If one's interest is in the accuracy of certification coding or the details of underlying cause selection, however, the entity axis codes would be more appropriate. In the present report the record axis codes generated by TRANSAX are used, with some modifications that are described later. The N.C. State Center for Health Statistics now has death data processed through TRANSAX for the years 1969-71 and 1975-1980. All years after 1967 are now available from the National Center for Health Statistics.

A factor that complicates looking at time trends is the 1979 change from the 8th to the 9th revision of the International Classification of Diseases (ICD). Comparability ratios have been developed for selected underlying cause of death groupings (reported in Leading Causes of Mortality, 1979), and in cases where the ratio departs from 1.0, deaths and death rates should be adjusted in order to compare across revisions. These comparability ratios were, however, developed solely on the basis of classification of underlying causes of death at a single point in time (1976), and how well they apply to mentioned conditions or other data years is unknown.

Another difference between the 8th and 9th ICD is that under the 8th revision "parenthetical" or "component" coding was included for certain diseases (5). This was eliminated in the 9th revision, and as a result the portrayal of trends for certain diseases is made difficult. See Appendix 1 for a discussion of this change.

Because of these changes in the ICD, most trends examined in this report will be for the period 1969-1978, all years under the 8th ICD. Inferences about changes between pre-1979 data and 1979 and later data should be made very carefully.

III. NORTH CAROLINA TRENDS IN CONDITIONS PRESENT AT DEATH

In 1969, 67.9 percent of North Carolina resident deaths had more than one condition mentioned on the death certificate, and by 1978 this had increased to 73.5 percent. Table 2 also shows that the percentage of deaths with 3, 4, 5, and 6 or more conditions mentioned consistently increased from 1969 to 1978.

Table 2

Deaths by Number of Conditions

North Carolina Residents, 1969 and 1978 and U.S., 1976

	Percent of Deaths		
No. of	North Carolina		U.S.
Conditions	1969	1978	1976
1	32.1	26.5	26.2
2	33.5	33.1	33.5
3	21.5	24.3	25.1
4	8.9	11.1	11.0
5	2.9	3.7	3.3
6 or more	1.1	1.3	0.9

NOTE: Nature of Injury codes are excluded. Sixty-nine diagnostic groups are counted, rather than the number of codes.

By 1978 North Carolina had approximately the same distribution of conditions by number as did the U.S. in 1976. But the general trend in North Carolina is the same as that for the U.S. as a whole: an increase in the number of conditions reported per death.

Table 3 portrays the percent of deaths with more than one condition by age, race, and sex. It is shown that the percent is fairly high for deaths under age 1, decreases steadily to a low at ages 15-24 where motor vehicle accidents are the leading cause, and then increases steadily through

Table 3

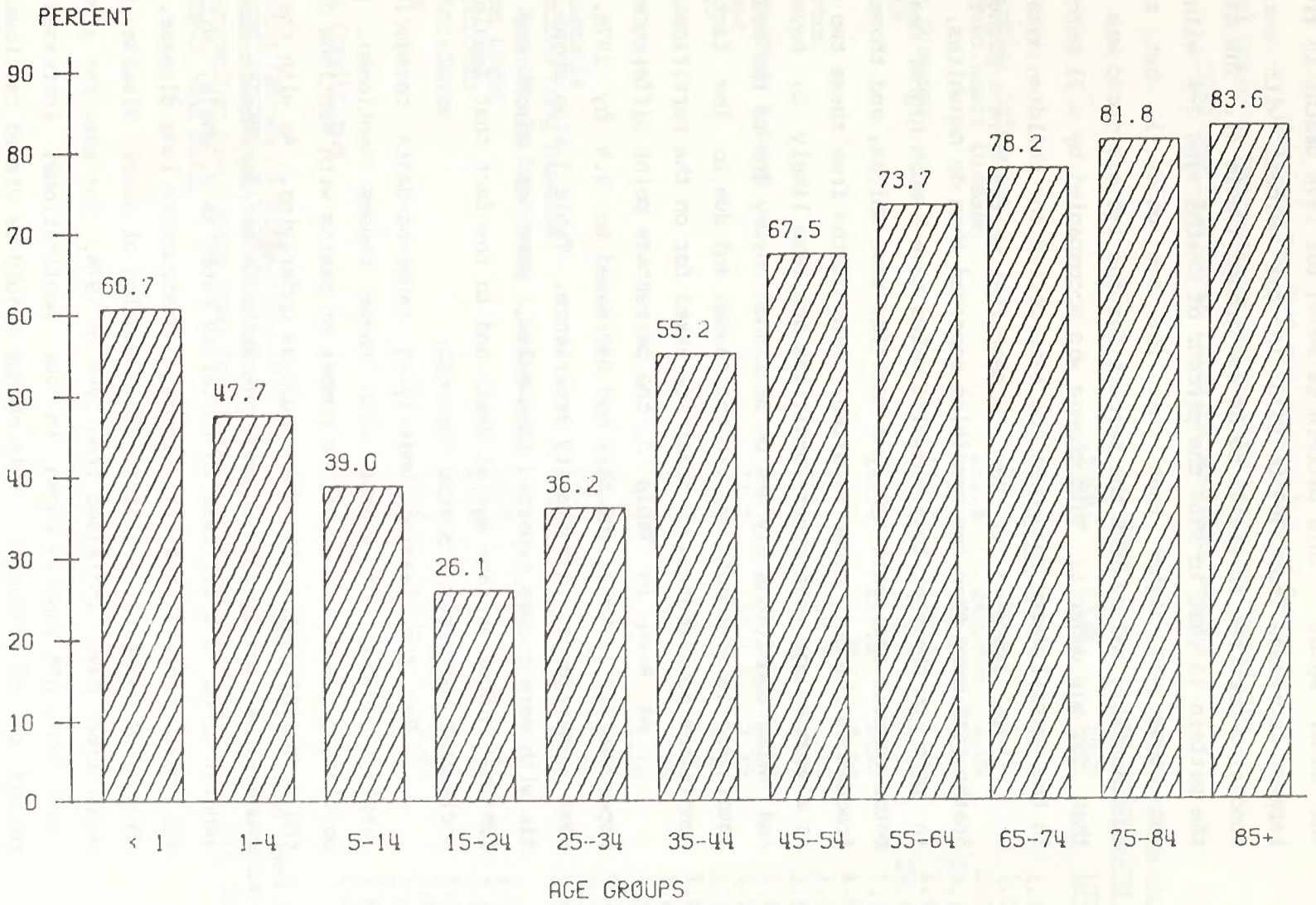
Percent of Deaths With More Than One Condition Reported, by Age, Race, Sex North Carolina Residents, 1969 and 1978

	Percent of deaths with more than 1 cause reported	
Age	1969	1978
< 1	52.7	60.7
1-4	55.6	47.7
5-14	38.7	39.0
15-24	26.7	26.1
25-34	38.0	36.2
35-44	51.3	55.2
45-54	60.4	67.5
55-64	67.8	73.7
65-74	74.0	78.2
75-84	79.6	81.8
85+	82.5	83.6
Race	1969	1978
White	70.4	75.0
Nonwhite	61.5	69.2
Sex	1969	1978
Male	65.1	71.4
Female	71.9	76.2
TOTAL	67.9	73.5

Note: Nature of injury codes excluded. Sixty-nine cause groups are counted, rather than the number of codes.

FIGURE 1

PERCENT OF DEATHS WITH MORE THAN ONE CAUSE REPORTED
BY AGE GROUP
NORTH CAROLINA RESIDENTS, 1978



the older ages. This pattern is shown for 1978 deaths in Figure 1. The largest increases from 1969 to 1978 in the percent with more than one condition occurred in the 45 to 64 age groups (Table 3). The main change in the pattern is that in 1969 the percent of deaths ages 1-4 with more than one cause was higher than that for age under 1, but this declined substantially and by 1978 the percent for the 1-4 age group was lower than that for age under 1. This change was accompanied by a 21 percent decrease in the overall death rate over the same period for children ages 1-4.

In Table 3 it can be seen that whites have a higher percent of deaths with more than one condition reported than do nonwhites. This is due in part to the fact that nonwhite males have a much higher death rate from motor vehicle accidents and from homicide than whites, and those causes are frequently the only cause reported. Many deaths from these two causes occur at a younger age when other conditions are less likely to have developed, and other conditions may not be mentioned anyway due to the acute nature of motor vehicle accidents and violent causes and due to the fact that only conditions contributing to death are asked for on the certificate.

As seen in Table 3, the percentage point difference between the races was 8.9 in 1969, and this had decreased to 5.8 by 1978, indicating some convergence in mortality experience. Table 3 also shows that females die with more causes reported than males, part of which may be due to females' higher average age at death and to the fact that females have fewer accidental and violent deaths reported.

For the leading underlying cause-of-death categories, Table 4 displays numbers of deaths with these causes mentioned, per 100,000 population, and ratios of the number of deaths with mentions of a cause to the number of deaths with that cause as underlying. As with the underlying cause rates usually published by the State Center for Health Statistics, the general trend is a decrease in mortality rates as a whole, with increases for most cancers and for chronic obstructive lung disease. Unlike the underlying cause rate, deaths with a mention of heart disease per 100,000 population have increased from 1969 to 1978. The rate for alcohol-related conditions, not usually shown in our publications, increased over this period by 52 percent. This change should be viewed cautiously, however,

Table 4

Mentions Per 100,000 Population by Cause

and Ratio of Mentions to Deaths with Cause as Underlying

1969 and 1978 North Carolina Resident Deaths

	Rate		Ratio of Mentions to Underlying	
	1969	1978	1969	1978
Heart Disease	412.6	425.9	1.29	1.40
Acute Myocardial Infarction	180.8	155.6	1.07	1.07
Other Ischemic Heart Disease	237.6	249.9	2.09	2.03
Hypertension	88.9	74.6	17.06	29.76
Cerebrovascular Disease	170.6	137.3	1.56	1.68
Arteriosclerosis	348.7	320.5	29.87	29.99
Cancer	138.4	175.9	1.13	1.13
Stomach	6.1	5.6	1.09	1.09
Colon & Rectum	15.7	19.6	1.14	1.17
Pancreas	7.4	9.3	1.07	1.04
Trachea, Bronchus & Lung	24.0	40.5	1.07	1.09
Female Breast	11.1	15.0	1.12	1.16
Cervix Uteri	4.5	3.0	1.13	1.15
Ovary, etc.	3.0	4.2	1.03	1.05
Prostate	11.7	14.4	1.46	1.46
Leukemia	8.1	7.7	1.16	1.34
Diabetes	61.0	58.2	3.34	4.20
Influenza & Pneumonia	93.8	77.4	2.64	3.11
Chronic Obstructive Lung Disease (including Bronchitis, Emphysema & Asthma)	34.0	53.4	2.67	2.52
Cirrhosis of the Liver	16.5	17.0	1.49	1.50
Nephritis & Nephrosis	11.0	13.2	2.23	2.66
Motor Vehicle Accidents	35.9	26.5	1.01	1.02
Other Accidents	56.8	53.9	1.87	1.88
Suicide	10.9	11.5	1.00	1.01
Homicide	12.7	11.6	1.00	1.02
Alcohol-related Conditions	17.0	25.8	1.58	1.84

Note: See Leading Causes of Mortality, 1978 for a list of the ICDA-8 codes used for these causes and Appendix 1 concerning some modifications for hypertension and arteriosclerosis. Codes used for alcohol-related conditions are 291, 303, 571.0, E860, and N980.

since alcoholic conditions are underreported and medical certification practices may have changed over this period.

For cancer (except prostate and leukemia), acute myocardial infarction, motor vehicle accidents, homicide, and suicide there are relatively few deaths where these causes are not the underlying cause (low ratio in Table 4). For most other causes the ratio of mentions to underlying is in the range of 1.5 to 2.0. In 1978, the causes of death with the highest ratio of mentions to underlying were arteriosclerosis (30.0), hypertension (29.8), and diabetes (4.2).[1] Arteriosclerosis is, in fact, mentioned or implied on about one-third of the death certificates of North Carolina residents (see Appendix 1). The fact that looking at deaths with a mention of these three conditions may present a much different picture than looking at deaths by underlying cause (usually published) warrants a more detailed investigation and section IV will deal specifically with arteriosclerosis, hypertension, and diabetes.

Table 5 presents average number of additional conditions mentioned, tabulated by underlying cause for 1969 and 1978. This can be taken as an index of the complexity of deaths with particular underlying causes. Accidents, suicide, and homicide have an average of less than one additional condition mentioned, while for diabetes the number is over two. For most causes the average number of additional conditions mentioned increased from 1969 to 1978.

[1]It should be noted that for hypertension and arteriosclerosis there is some inconsistency in the way that mentions and underlying-cause deaths are counted, as explained in Appendix 1. For example, only code 440 is counted as an arteriosclerotic underlying cause while code 440 and other codes are counted as a "mention" of arteriosclerosis.

Table 5

Average Number of Additional Conditions Mentioned, by Underlying Cause

North Carolina Resident Deaths 1969 and 1978

	1969	1978
Heart Disease	1.36	1.58
Hypertension	1.58	1.85
Cerebrovascular Disease	1.26	1.38
Arteriosclerosis	1.53	1.50
Cancer	1.13	1.19
Diabetes	2.08	2.23
Influenza & Pneumonia	1.38	1.68
Chronic Obstructive Lung Disease	1.89	1.73
Cirrhosis of the Liver	1.26	1.40
Nephritis & Nephrosis	1.88	1.93
Motor Vehicle Accidents	0.23	0.18
Other Accidents	0.75	0.84
Suicide	0.18	0.32
Homicide	0.20	0.16
Total	1.21	1.37

Note: Nature of injury codes are excluded. Sixty-nine cause groups are counted, rather than the number of codes.

IV. ARTERIOSCLEROSIS, HYPERTENSION, AND DIABETES: FREQUENTLY MENTIONED DISEASES CONTRIBUTING TO DEATH

Since the ratio of mentions to underlying cause is high for arteriosclerosis, hypertension, and diabetes, and only underlying cause tabulations usually appear in SCHS publications, it was considered desirable to present some demographic and geographic breakouts for mentions of these conditions. These diseases are implicated with many other conditions and thus contribute to a large number of deaths each year in North Carolina.

Table 6 displays rates of mention of these three conditions for 1969 and 1978 by race-sex group, by age, and by Health Service Area. The general picture is a substantial decline from 1969 to 1978 in the rates for arteriosclerosis and hypertension, and a smaller decline in the rate for diabetes. The few exceptions to these general trends are mentioned below.

White males have the highest rate of mentions of arteriosclerosis per 100,000 population, with white females and nonwhite males close together at a lower level, and nonwhite females much lower still. For hypertension, on the other hand, there is a clear racial differential, with nonwhites having about twice the rate of whites. For diabetes, nonwhite females stand out with a rate from 40 to 78 percent higher than the other three groups. An exception here to the trend of decline over time is that the diabetes rate for nonwhite males increased from 1969 to 1978. Over the same time period the death rate for nonwhite males with diabetes as the underlying cause decreased by 20 percent from 19.4 to 15.6 per 100,000. Thus it appears that the prevalence of diabetes among nonwhite male decedents has increased, while at the same time the assignment of diabetes as the underlying cause of death has decreased.

There was a steady and large increase with age in the rate of mentions of these three conditions in both 1969 and 1978, as is shown in Table 6, and the rate for each age group declined between 1969 and 1978. Further examination of age-specific data not shown in Table 6 reveals that the overall increase in the nonwhite male diabetes rate was due entirely to increases in the 45-74 age groups on the order of 20 percent from 1969 to 1978. The rate in all other nonwhite male age groups declined over this period.

Table 6

North Carolina Deaths per 100,000 Population

With Mention of Arteriosclerosis, Hypertension, and Diabetes, 1969 and 1978

by Race-Sex Group, by Age, and by Health Service Area

	Arteriosclerosis		Hypertension		Diabetes	
	1969	1978	1969	1978	1969	1978
Race-Sex						
White Male	386	366	67	58	55	53
White Female	320	303	68	62	60	56
Nonwhite Male	339	304	158	123	51	57
Nonwhite Female	309	257	154	117	91	80
Age						
0-24	1	1	0	0	1	0
25-34	9	4	5	3	5	3
35-44	49	34	33	17	15	12
45-54	187	151	88	62	47	43
55-64	607	509	224	166	162	132
65-74	1752	1321	474	355	349	294
75-84	4898	3686	922	722	691	558
85+	11674	8611	1607	1038	840	713
Health Service Area						
I	396	361	83	65	60	56
II	336	316	76	71	55	57
III	340	309	81	75	54	56
IV	330	300	94	78	60	55
V	326	300	90	67	59	53
VI	344	331	107	91	74	70
Total N.C. Residents	349	320	89	75	61	58

The third section of Table 6 shows the rates for these three conditions by Health Service Area (see Appendix 2, a map of the HSA regions). These geographic areas rather than counties were used because of the uncertainty of reporting consistency from one county to another. Where only a few certifiers fill out most of the death certificates in a county, variations in recording practices by one or two individuals may have a large effect on the reported rates, particularly where conditions in addition to the major cause of death are concerned. For example, for the 1975-78 mentions data in the 1978 Leading Causes of Mortality, rates from one county to another for arteriosclerosis, hypertension, and diabetes varied by a magnitude of at least seven. It is unlikely that the true level of disease varies this much, and an unknown portion of this must be attributed to differences in the medical completeness of death certificate recording. Aggregations at the HSA level are used here to minimize this problem. Smaller geographic levels could be examined by combining years of data and grouping those counties with few deaths.

Table 6 reveals that HSA I (western) has the highest number of mentions of arteriosclerosis per 100,000 population, though an age-adjusted rate would be somewhat lower since the population in that area has a high average age. This HSA is below the state average for hypertension and diabetes and an age-adjusted rate would show an even lower risk of these two diseases for decedents of that region. Another exception to the general pattern of declining rates is that for HSAs II and III there was no change or a slight increase from 1969 to 1978 in the number of mentions of diabetes per 100,000 population. This could be due to an increase in the nonwhite female population in these regions (with a high race-sex-specific rate) and/or to an increase in the race-sex-specific rates for diabetes in these regions.

The biggest deviations among HSAs are the very high rates for hypertension and for diabetes in HSA VI. Though these have decreased from 1969 to 1978, they are still well above the state average. Since HSA VI has a large nonwhite population, and the prevalence of hypertension and diabetes is higher among nonwhites, we would expect these rates to be somewhat higher. But data not shown in Table 6 reveal that in 1978 the hypertension mentions per 100,000 for whites in HSA VI were 67 compared to 60 for all

N.C. whites, and for nonwhites in HSA VI this rate was 136 compared to 120 for all N.C. nonwhites. Also, in 1978 nonwhite females in HSA VI had a diabetes rate of 96, vs. 80 for all N.C. nonwhite females. Thus the higher rates in HSA VI appear to be due to a higher risk of hypertension and diabetes as well as to differences in the race-sex composition of the population, though it is possible that death certificate recording practices contribute to these differences.

V. PATTERNS IN 1979 AND 1980

In the 1976 through 1978 editions of Leading Causes of Mortality, large matrices showing combinations of conditions on the death certificate were presented. These tables were not included in the 1979 and 1980 editions because of the considerations mentioned in the Introduction to this report, and the main purpose of this section is to present the data for 1979 and 1980 in order to "catch-up" on these tabulations. These multiple-cause tables for 1981 will be included in the 1981 Leading Causes of Mortality.

Tables 7 and 9 show numbers of deaths with selected conditions mentioned by underlying cause for 1979 and 1980, and Tables 8 and 10 show numbers of deaths with selected combinations of conditions in 1979 and 1980 (not considering which condition is the underlying cause). See Leading Causes of Mortality, 1979 for a list of the ICD-9 codes used for these causes and Appendix 1 concerning some modifications for hypertension and atherosclerosis (called arteriosclerosis under the 8th ICD). Codes used for alcohol-related conditions are 291, 303, 305.0, 571.0-571.3, 790.3, E860, and N980. Changes from the 8th to the 9th revision of the International Classification of Diseases make it difficult to examine trends across 1978-1979, but a few comments are appropriate about differences between these 1979 and 1980 tables and those published in 1978 and before.

Lack of comparability due to coding changes must be considered for a few causes, though the comparability ratios published and discussed in the 1979 Leading Causes of Mortality were developed only for underlying cause and no parallel work has been done for mentioned conditions. Major areas affected and the (underlying cause) comparability ratio to be applied to 1978 and earlier years are: other ischemic heart disease (.76), pneumonia and influenza (.93), and nephritis and nephrosis (1.74). Chronic obstructive pulmonary disease is a combined category roughly comparable to bronchitis, emphysema, and asthma plus "chronic obstructive lung disease" (code 519.3) in the 1976-78 Leading Causes of Mortality. Also, hypertension and atherosclerosis are different in 1979 because "components" were counted in 1978 and earlier Leading Causes of Mortality, whereas in 1979 and 1980 codes implying these conditions (e.g. certain types of heart disease) were counted as well as the specific codes for these two diseases (see Appendix

TABLE 7

DEATHS BY SELECTED UNDERLYING CAUSE AND MENTIONED CONDITIONS

NORTH CAROLINA RESIDENTS, 1979

	Underlying Cause of Death	Total Underlying*	CONDITIONS MENTIONED ON DEATH CERTIFICATE											
			1	2	3	4	5	6	7	8	9	10	11	12
1	Diseases of heart	17337	17336	8110	8175	2517	1944	9634	640	11	75	12	88	58
2	Acute myocardial infarction	8076	8076	8076	3392	1001	458	3924	199	1	15	1	35	23
3	Other forms of ischemic heart disease	4698	4698	0	4698	530	559	3836	217	5	32	6	27	12
4	Hypertension with or without renal disease	230	70	0	0	227	29	62	10	1	0	0	2	0
5	Cerebrovascular disease	4688	1212	66	401	693	4688	2311	137	1	23	1	13	17
6	Atherosclerosis	577	267	0	0	0	0	577	29	0	2	0	2	6
7	Cancer	9099	1831	66	369	199	266	580	9099	305	1046	461	2243	751
8	Stomach	297	58	2	12	7	5	14	297	297	1	0	1	0
9	Colon, rectum, etc.	1030	189	12	39	29	23	76	1030	0	1030	0	3	1
10	Pancreas	459	85	2	20	13	13	32	459	1	0	459	0	0
11	Trachea, bronchus and lung	2227	407	14	99	38	52	145	2227	2	5	2	2227	4
12	Female breast	742	122	5	17	16	14	33	742	2	2	0	5	742
13	Cervix uteri	124	19	0	2	3	2	2	124	0	0	0	0	1
14	Ovary & other uterine adnexa	232	52	0	6	5	2	7	232	0	2	0	0	1
15	Prostate	575	144	6	41	17	28	76	575	0	1	0	0	0
16	Leukemia	374	85	3	15	6	47	25	374	0	0	0	1	0
17	Diabetes Mellitus	799	533	224	186	159	188	336	24	0	3	0	2	4
18	Pneumonia & Influenza	1053	364	25	107	37	150	245	77	1	6	2	12	5
19	Chronic obstructive pulmonary disease & allied conditions	1088	544	53	114	30	53	169	70	0	3	0	25	2
20	Chronic liver disease and cirrhosis	711	112	1	12	10	6	20	21	0	2	1	2	3
21	Nephritis, nephrotic syndrome & nephrosis	445	209	15	40	13	33	76	15	0	2	0	2	3
22	Motor vehicle accidents	1537	74	3	10	2	3	10	0	0	0	0	0	0
23	All other accidents & adverse effects	1512	278	23	45	21	47	70	30	0	1	0	2	1
24	Suicide	703	26	1	8	6	6	6	5	0	0	0	1	0
25	Homicide	667	22	0	2	0	1	2	0	0	0	0	0	0
	TOTAL DEATHS**	46640	24840	8750	9768	4114	7829	14719	10344	321	1186	479	2425	869

TABLE 7 (continued)

DEATHS BY SELECTED UNDERLYING CAUSE AND MENTIONED CONDITIONS

NORTH CAROLINA RESIDENTS, 1979

	Underlying Cause of Death	CONDITIONS MENTIONED ON DEATH CERTIFICATE													Alcohol
		13	14	15	16	17	18	19	20	21	22	23	24	25	
1	Diseases of heart	15	5	125	32	1464	659	949	106	500	13	441	1	2	199
2	Acute myocardial infarction	3	1	38	14	726	108	373	25	102	5	109	0	0	72
3	Other forms of ischemic heart disease	5	1	46	7	385	213	344	39	173	3	148	0	2	49
4	Hypertension with or without renal disease	0	1	1	0	30	8	6	2	9	0	4	0	0	3
5	Cerebrovascular disease	0	2	36	6	343	407	118	18	100	5	154	1	0	23
6	Atherosclerosis	1	1	3	2	30	52	29	2	65	0	33	0	0	1
7	Cancer	130	236	597	389	248	494	334	40	295	1	202	0	0	30
8	Stomach	0	0	1	0	8	8	4	0	5	0	8	0	0	1
9	Colon, rectum, etc.	0	3	3	1	21	31	12	4	28	0	30	0	0	0
10	Pancreas	0	0	1	0	28	19	8	4	6	0	11	0	0	3
11	Trachea, bronchus and lung	3	0	8	2	51	167	207	6	16	0	42	0	0	4
12	Female breast	1	0	0	2	16	21	5	0	12	0	11	0	0	0
13	Cervix uteri	124	0	0	0	2	1	1	0	26	0	2	0	0	0
14	Ovary & other uterine adnexa	0	232	0	0	4	7	1	0	8	0	6	0	0	0
15	Prostate	0	0	575	2	19	35	18	2	59	0	6	0	0	0
16	Leukemia	0	1	1	374	9	37	14	0	10	0	7	0	0	0
17	Diabetes Mellitus	1	0	3	2	799	43	10	7	94	0	33	0	0	6
18	Pneumonia & Influenza	2	1	12	4	54	1053	66	19	55	0	35	0	0	23
19	Chronic obstructive pulmonary disease & allied conditions	0	4	15	3	24	172	1088	8	29	0	30	0	0	12
20	Chronic liver disease and cirrhosis	0	0	0	0	27	47	21	704	43	0	30	0	0	370
21	Nephritis, nephrotic syndrome & nephrosis	0	0	0	1	21	43	15	5	445	0	26	0	0	6
22	Motor vehicle accidents	0	0	0	0	4	10	1	6	9	1537	8	0	0	68
23	All other accidents & adverse effects	0	0	8	3	26	62	22	21	38	3	1512	0	0	247
24	Suicide	0	0	2	0	3	3	2	1	2	0	2	703	0	33
25	Homicide	0	0	0	0	1	4	0	4	5	0	7	0	667	25
	TOTAL DEATHS**	154	250	817	458	3290	3453	2875	1026	2087	1565	3036	711	672	1509

*Numbers shown here are the final underlying frequencies. They are sometimes larger than numbers shown on the diagonal due to the fact that a sequence of conditions may imply an underlying cause that is not specifically mentioned on the death certificate.

**Differences between these totals and the summation over causes are attributable to causes not given in the table.

NOTE: In this table, a death is counted only once in a condition category although several conditions within the category may have been reported or a single condition may have been recorded more than once on the death certificate.

TABLE 8

DEATHS BY MENTIONED CONDITIONS

NORTH CAROLINA RESIDENTS, 1979

	Conditions Mentioned On Death Certificate	CONDITIONS MENTIONED ON DEATH CERTIFICATE											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Diseases of heart	24840	8750	9768	3279	3600	12383	2683	74	291	99	533	210
2	Acute myocardial infarction	8750	8750	3532	1074	574	4143	286	3	30	4	52	30
3	Other forms of ischemic heart disease	9768	3532	9768	1068	1325	7900	719	18	88	27	144	45
4	Hypertension with or without renal disease	3279	1074	1068	4114	1348	1565	304	8	43	14	48	33
5	Cerebrovascular disease	3600	574	1325	1348	7829	4092	486	6	56	14	75	41
6	Atherosclerosis	12383	4143	7900	1565	4092	14719	1146	22	149	40	208	90
7	Cancer	2683	286	719	304	486	1146	10344	321	1186	479	2425	869
8	Stomach	74	3	18	8	6	22	321	321	1	1	3	2
9	Colon, rectum, rectosigmoid junction & anus	291	30	88	43	56	149	1186	1	1186	1	10	6
10	Pancreas	99	4	27	14	14	40	479	1	1	479	2	0
11	Trachea, bronchus and lung	533	52	144	48	75	208	2425	3	10	2	2425	9
12	Female breast	210	30	45	33	41	90	869	2	6	0	9	869
13	Cervix uteri	38	4	10	8	6	14	154	0	0	0	3	2
14	Ovary & other uterine adnexa	62	1	8	6	4	13	250	0	5	0	0	1
15	Prostate	310	46	121	40	90	206	817	1	4	1	8	0
16	Leukemia	134	17	30	9	56	58	458	0	1	0	3	3
17	Diabetes Mellitus	2397	980	1042	713	816	1654	337	8	30	28	57	28
18	Pneumonia & Influenza	1534	158	495	197	807	1140	646	11	44	22	194	34
19	Chronic obstructive pulmonary disease & allied conditions	1843	447	757	197	283	1062	460	6	20	9	248	9
20	Chronic liver disease and cirrhosis	276	34	77	33	32	98	71	0	9	5	9	4
21	Nephritis, nephrotic syndrome & nephrosis	1158	135	330	69	236	633	353	6	35	7	26	19
22	Motor vehicle accidents	93	8	16	3	9	17	1	0	0	0	0	0
23	All other accidents & adverse effects	1057	153	304	115	306	505	277	9	38	12	48	21
24	Suicide	27	1	8	6	7	6	5	0	0	0	1	0
25	Homicide	24	0	4	0	1	4	0	0	0	0	0	0
26	Alcohol-related conditions	402	82	110	68	40	114	53	1	0	3	11	2
	TOTAL DEATHS*	24840	8750	9768	4114	7829	14719	10344	321	1186	479	2425	869

TABLE 8 (continued)

DEATHS BY MENTIONED CONDITIONS

NORTH CAROLINA RESIDENTS, 1979

	Conditions Mentioned on Death Certificate	CONDITIONS MENTIONED ON DEATH CERTIFICATE													
		13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	Diseases of heart	38	62	310	134	2397	1534	1843	276	1158	93	1057	27	24	402
2	Acute myocardial infarction	4	1	46	17	980	158	447	34	135	8	153	1	0	82
3	Other forms of ischemic heart disease	10	8	121	30	1042	495	757	77	330	16	304	8	4	110
4	Hypertension with or without renal disease	8	6	40	9	713	197	197	33	69	3	115	6	0	68
5	Cerebrovascular disease	6	4	90	56	816	807	283	32	236	9	306	7	1	40
6	Atherosclerosis	14	13	206	58	1654	1140	1062	98	633	17	505	6	4	114
7	Cancer	154	250	817	458	337	646	460	71	353	1	277	5	0	53
8	Stomach	0	0	1	0	8	11	6	0	6	0	9	0	0	1
9	Colon, rectum, rectosigmoid junction & anus	0	5	4	1	30	44	20	9	35	0	38	0	0	0
10	Pancreas	0	0	1	0	28	22	9	5	7	0	12	0	0	3
11	Trachea, bronchus and lung	3	0	8	3	57	194	248	9	26	0	48	1	0	11
12	Female breast	2	1	0	3	28	34	9	4	19	0	21	0	0	2
13	Cervix uteri	154	0	0	0	7	4	2	0	27	0	3	0	0	1
14	Ovary & other uterine adnexa	0	250	0	1	7	9	5	0	8	0	6	0	0	0
15	Prostate	0	0	817	3	29	68	43	3	70	0	19	2	0	1
16	Leukemia	0	1	3	458	19	46	18	0	14	0	14	0	0	0
17	Diabetes Mellitus	7	7	29	19	3290	224	111	54	204	4	112	3	1	42
18	Pneumonia & Influenza	4	9	68	46	224	3453	370	72	232	10	196	3	4	92
19	Chronic obstructive pulmonary disease & allied conditions	2	5	43	18	111	370	2875	44	106	2	97	2	0	65
20	Chronic liver disease and cirrhosis	0	0	3	0	54	72	44	1026	67	6	60	1	4	470
21	Nephritis, naphrotic syndrome & nephrosis	27	8	70	14	204	232	106	67	2087	10	137	2	5	59
22	Motor vehicle accidents	0	0	0	0	4	10	2	6	10	1565	11	0	0	71
23	All other accidents & adverse effects	3	6	19	14	112	196	97	60	137	11	3036	2	7	329
24	Suicide	0	0	2	0	3	3	2	1	2	0	2	711	0	37
25	Homicide	0	0	0	0	1	4	0	4	5	0	7	0	672	26
26	Alcohol-related conditions	1	0	1	0	42	92	65	470	59	71	329	37	26	1509
	TOTAL DEATHS*	154	250	817	458	3290	3453	2875	1026	2087	1565	3036	711	672	1509

*Differences between these totals and the summation over causes are attributable to causes not given in the table and to multiple counting of a condition if it appears in combination with more than one other condition on a certificate.

NOTE: In this table, a death is counted only once in a condition category although several conditions within the category may have been reported or a single condition may have been recorded more than once on the death certificate.

TABLE 9

DEATHS BY SELECTED UNDERLYING CAUSE AND MENTIONED CONDITIONS

NORTH CAROLINA RESIDENTS, 1980

	Underlying Cause of Death	Total Underlying*	CONDITIONS MENTIONED ON DEATH CERTIFICATE											
			1	2	3	4	5	6	7	8	9	10	11	12
1	Diseases of heart	17579	17577	8040	8303	2561	2021	9633	598	8	79	7	96	49
2	Acute myocardial infarction	8008	8008	8008	3457	988	500	3901	189	3	27	4	34	13
3	Other forms of ischemic heart disease	4769	4769	0	4769	530	545	3730	204	5	23	1	31	11
4	Hypertension with or without renal disease	243	89	0	0	239	26	70	5	0	0	0	0	2
5	Cerebrovascular disease	4760	1296	70	416	766	4760	2184	135	6	13	2	13	19
6	Atherosclerosis	568	269	0	0	0	1	568	28	0	5	1	1	1
7	Cancer	9698	2078	88	383	214	250	579	9698	283	1058	539	2393	797
8	Stomach	274	58	3	8	2	6	12	274	274	1	0	1	0
9	Colon, rectum, etc.	1038	204	11	48	34	26	68	1038	2	1038	1	0	2
10	Pancreas	532	95	3	15	9	14	26	532	0	1	532	1	0
11	Trachea, bronchus and lung	2374	462	18	99	40	55	132	2374	0	6	2	2374	3
12	Female breast	788	146	5	29	33	14	41	788	1	1	0	0	788
13	Cervix uteri	164	37	0	3	4	3	6	164	0	0	0	1	1
14	Ovary & other uterine adnexa	231	53	1	5	8	5	9	231	0	3	0	1	1
15	Prostate	616	170	9	40	11	19	65	616	0	2	0	0	0
16	Leukemia	393	117	7	12	8	27	19	393	0	1	0	0	0
17	Diabetes Mellitus	866	561	168	198	145	195	377	24	0	3	0	0	5
18	Pneumonia & Influenza	1259	483	24	135	40	181	274	66	1	2	3	14	4
19	Chronic obstructive pulmonary disease & allied conditions	1221	614	50	117	45	58	199	80	2	7	1	27	3
20	Chronic liver disease and cirrhosis	715	149	7	26	21	12	30	6	1	0	0	0	3
21	Nephritis, nephrotic syndrome & nephrosis	479	249	23	43	10	52	84	24	0	3	1	2	0
22	Motor vehicle accidents	1570	67	7	13	4	7	8	3	0	0	0	1	0
23	All other accidents & adverse effects	1592	287	17	47	25	48	74	23	0	4	0	3	1
24	Suicide	657	18	2	6	2	3	7	4	0	0	0	1	0
25	Homicide	669	30	0	0	1	2	1	1	0	0	0	0	0
	TOTAL DEATHS**	48426	25851	8656	10011	4285	8016	14754	10928	312	1195	561	2596	905

TABLE 9 (continued)

DEATHS BY SELECTED UNDERLYING CAUSE AND MENTIONED CONDITIONS

NORTH CAROLINA RESIDENTS, 1980

	Underlying Cause of Death	CONDITIONS MENTIONED ON DEATH CERTIFICATE													Alcohol
		13	14	15	16	17	18	19	20	21	22	23	24	25	
1	Diseases of heart	12	7	130	29	1552	645	1053	124	540	11	448	0	2	185
2	Acute myocardial infarction	3	3	39	6	780	144	390	30	145	1	103	0	0	73
3	Other forms of ischemic heart disease	3	3	54	12	415	217	383	49	167	3	154	0	2	44
4	Hypertension with or without renal disease	0	0	1	0	29	14	9	2	14	1	5	0	0	9
5	Cerebrovascular disease	0	0	27	7	378	424	97	14	112	3	151	0	2	23
6	Atherosclerosis	0	0	7	1	44	43	19	1	62	0	31	0	0	2
7	Cancer	168	238	651	410	290	512	368	41	337	0	211	1	0	27
8	Stomach	0	1	2	0	6	6	2	1	3	0	4	0	0	1
9	Colon, rectum, etc.	0	2	5	2	39	42	17	4	31	0	47	0	0	3
10	Pancreas	0	1	6	1	29	14	9	4	19	0	14	0	0	0
11	Trachea, bronchus and lung	2	0	8	5	50	159	202	7	19	0	37	0	0	11
12	Female breast	0	2	0	1	36	29	6	2	11	0	12	0	0	0
13	Cervix uteri	164	0	0	0	6	1	2	0	36	0	6	0	0	0
14	Ovary & other uterine adnexa	0	231	0	0	10	5	1	2	5	0	4	0	0	0
15	Prostate	0	0	616	0	22	38	30	0	69	0	9	0	0	0
16	Leukemia	0	0	1	393	16	38	8	1	21	0	8	0	0	0
17	Diabetes Mellitus	1	0	3	3	866	52	13	12	126	0	31	0	1	8
18	Pneumonia & Influenza	1	2	8	6	76	1259	64	18	67	1	43	0	0	34
19	Chronic obstructive pulmonary disease & allied conditions	1	1	15	2	30	186	1221	11	33	0	30	0	1	30
20	Chronic liver disease and cirrhosis	0	0	0	0	27	50	27	705	52	0	18	0	0	395
21	Nephritis, nephrotic syndrome & nephrosis	2	0	1	2	18	38	18	6	479	0	12	0	0	4
22	Motor vehicle accidents	0	0	1	0	7	9	3	4	7	1570	12	0	0	69
23	All other accidents & adverse effects	1	0	2	5	25	59	24	23	24	2	1592	0	0	254
24	Suicide	0	0	1	0	4	2	3	1	2	0	3	657	0	22
25	Homicide	0	0	0	0	0	1	1	2	2	0	4	0	669	17
	TOTAL DEATHS**	190	249	868	483	3598	3740	3151	1069	2335	1596	3129	658	678	1562

*Numbers shown here are the final underlying frequencies. They are sometimes larger than numbers shown on the diagonal due to the fact that a sequence of conditions may imply an underlying cause that is not specifically mentioned on the death certificate.

**Differences between these totals and the summation over causes are attributable to causes not given in the table.

NOTE: In this table, a death is counted only once in a condition category although several conditions within the category may have been reported or a single condition may have been recorded more than once on the death certificate.

TABLE 10

DEATHS BY MENTIONED CONDITIONS

NORTH CAROLINA RESIDENTS, 1980

	Conditions Mentioned on Death Certificate	CONDITIONS MENTIONED ON DEATH CERTIFICATE											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Diseases of heart	25851	8656	10011	3362	3774	12512	2905	73	306	110	597	221
2	Acute myocardial infarction	8656	8656	3590	1060	615	4119	295	8	40	7	55	20
3	Other forms of ischemic heart disease	10011	3590	10011	1132	1300	7789	724	18	82	18	158	51
4	Hypertension with or without renal disease	3362	1060	1132	4285	1383	1630	316	5	48	9	56	49
5	Cerebrovascular disease	3774	615	1300	1383	8016	4006	466	13	51	17	79	44
6	Atherosclerosis	12512	4119	7789	1630	4006	14754	1063	22	121	32	209	85
7	Cancer	2905	295	724	316	466	1063	10928	312	1195	561	2596	905
8	Stomach	73	8	18	5	13	22	312	312	3	0	1	1
9	Colon, rectum, rectosigmoid junction & anus	306	40	82	48	51	121	1195	3	1195	3	7	4
10	Pancreas	110	7	18	9	17	32	561	0	3	561	3	0
11	Trachea, bronchus and lung	597	55	158	56	79	209	2596	1	7	3	2596	3
12	Female breast	221	20	51	49	44	85	905	1	4	0	3	905
13	Cervix uteri	57	3	9	7	4	14	190	0	1	0	3	1
14	Ovary & other uterine adnexa	62	4	9	9	5	12	249	1	7	1	1	4
15	Prostate	346	50	126	31	66	185	868	2	9	6	11	0
16	Leukemia	157	13	29	10	39	49	483	0	4	1	5	1
17	Diabetes Mellitus	2590	994	1163	776	865	1772	380	7	48	30	62	52
18	Pneumonia & Influenza	1685	194	564	195	840	1110	654	11	51	18	189	41
19	Chronic obstructive pulmonary disease & allied conditions	2011	467	822	216	256	1080	516	4	30	10	240	10
20	Chronic liver disease and cirrhosis	332	41	113	43	31	124	53	3	4	4	9	5
21	Nephritis, nephrotic syndrome & nephrosis	1332	203	361	72	293	679	422	4	42	21	26	17
22	Motor vehicle accidents	80	8	17	7	10	14	3	0	0	0	1	0
23	All other accidents & adverse effects	1078	146	305	113	295	504	285	6	58	17	49	22
24	Suicide	19	2	6	2	3	7	5	0	0	0	1	0
25	Homicide	32	0	2	1	4	2	1	0	0	0	0	0
26	Alcohol-related conditions	421	84	110	90	46	121	35	1	3	0	14	1
	TOTAL DEATHS*	25851	8656	10011	4285	8016	14754	10928	312	1195	561	2596	905

TABLE 10 (continued)

DEATHS BY MENTIONED CONDITIONS

NORTH CAROLINA RESIDENTS, 1980

	Conditions Mentioned On Death Certificate	CONDITIONS MENTIONED ON DEATH CERTIFICATE													
		13	14	15	16	17	18	19	20	21	22	23	24	25	26
1	Diseases of heart	57	62	346	157	2590	1685	2011	332	1332	80	1078	19	32	421
2	Acute myocardial infarction	3	4	50	13	994	194	467	41	203	8	146	2	0	84
3	Other forms of ischemic heart disease	9	9	126	29	1163	564	822	113	361	17	305	6	2	110
4	Hypertension with or without renal disease	7	9	31	10	776	195	216	43	72	7	113	2	1	90
5	Cerebrovascular disease	4	5	66	39	865	840	256	31	293	10	295	3	4	46
6	Atherosclerosis	14	12	185	49	1772	1110	1080	124	679	14	504	7	2	121
7	Cancer	190	249	868	483	380	654	516	53	422	3	285	5	1	35
8	Stomach	0	1	2	0	7	11	4	3	4	0	6	0	0	1
9	Colon, rectum, rectosigmoid junction & anus	1	7	9	4	48	51	30	4	42	0	58	0	0	3
10	Pancreas	0	1	6	1	30	18	10	4	21	0	17	0	0	0
11	Trachea, bronchus and lung	3	1	11	5	62	189	248	9	26	1	49	1	0	14
12	Female breast	1	4	0	1	52	41	10	5	17	0	22	0	0	1
13	Cervix uteri	190	0	0	0	10	2	3	0	38	0	10	0	0	0
14	Ovary & other uterine adnexa	0	249	0	0	10	7	3	2	5	0	4	0	0	0
15	Prostate	0	0	868	2	31	63	63	1	87	1	13	1	0	1
16	Leukemia	0	0	2	483	23	52	14	2	28	0	13	0	0	0
17	Diabetes Mellitus	10	10	31	23	3598	236	150	54	270	7	121	4	1	58
18	Pneumonia & Influenza	2	7	63	52	236	3740	377	95	242	11	184	2	2	106
19	Chronic obstructive pulmonary disease & allied conditions	3	3	63	14	150	377	3151	67	115	3	101	3	2	87
20	Chronic liver disease and cirrhosis	0	2	1	2	54	95	67	1069	73	4	55	1	3	501
21	Nephritis, nephrotic syndrome & nephrosis	38	5	87	28	270	242	115	73	2335	7	113	2	2	42
22	Motor vehicle accidents	0	0	1	0	7	11	3	4	7	1596	15	0	0	72
23	All other accidents & adverse effects	10	4	13	13	121	184	101	55	113	15	3129	3	5	330
24	Suicide	0	0	1	0	4	2	3	1	2	0	3	658	0	23
25	Homicide	0	0	0	0	1	2	2	3	2	0	5	0	678	19
26	Alcohol-related conditions	0	0	1	0	58	106	87	501	42	72	330	23	19	1562
	TOTAL DEATHS*	190	249	868	483	3598	3740	3151	1069	2335	1596	3129	658	678	1562

*Differences between these totals and the summation over causes are attributable to causes not given in the table and to multiple counting of a condition if it appears in combination with more than one other condition on a certificate.

NOTE: In this table, a death is counted only once in a condition category although several conditions within the category may have been reported or a single condition may have been recorded more than once on the death certificate.

1). Another difference between the tables published in the 1978 Leading Causes of Mortality and the data in this publication, based on TRANSAX, is that the number of deaths with non-motor-vehicle accidents mentioned is substantially larger. This is because, for those deaths where only a nature of injury (N) code was recorded in the conditions mentioned field, TRANSAX generates a companion external cause of injury (E) code. Thus such deaths would be counted under "other accidents," whereas a mention of an accident would not have been counted before based only on an N code.

With these cautions about comparing the tables here with those in 1978 and earlier publications, we will examine some of the patterns evident in the 1980 data. Comparisons to the 1979 data will be left to the interested reader.

Table 9 (and Table 7 for 1979) shows number of deaths with selected conditions mentioned tabulated by underlying cause. The total number of deaths with mention of a condition is shown in the bottom row of the table. As for 1969 and 1978, around one-third of the death certificates had a mention of atherosclerosis (arteriosclerosis under the 8th ICD). Again, conditions with high ratios of mentions (bottom row) to deaths with that condition as underlying cause (first column of the table) are atherosclereosis, hypertension, and diabetes. Of the 17,579 deaths with heart disease as underlying, 2561 or 14.6 percent had a mention of hypertension, 9633 or 54.8 percent had a mention of atherosclerosis, 1552 or 8.8 percent had a mention of diabetes, and 2021 or 11.5 percent had a mention of cerebrovascular disease. To look at this from a different perspective, heart disease was the underlying cause for 60 percent of all mentions of hypertension, 65 percent of atherosclerosis mentions, 43 percent of diabetes mentions, and 25 percent of all cerebrovascular disease mentions. Atherosclerosis, hypertension, and diabetes are important conditions associated with cerebrovascular disease as the underlying cause. Sixteen percent of deaths due to non-motor-vehicle accidents had a mention of alcohol. For motor vehicle accidents this percent is only 4.4, which indicates a reporting problem. Even if all alcohol use were mentioned on the death certificate, there would be an understatement of alcohol involvement in motor vehicle accidents since persons other than the decedent may have been intoxicated. The number of deaths with mention of an alcohol-

related condition per 100,000 population continued to increase, from 25.8 in 1978 to 26.6 in 1980.

Table 10 (and Table 8 for 1979) shows combinations of conditions mentioned on the death certificate, without regard to the underlying cause. As in Table 9, the bottom row shows the total number of deaths with mention of a condition. These totals are also in the diagonal of the table, and the upper right-hand portion of the table is a mirror image of the bottom left-hand portion. Conditions may be counted more than once here: for example, if condition A, B, and C were mentioned on a death certificate, A would be counted in both of the combinations AB and AC, though only once for that certificate in the total.

One way to analyze the data in Table 10 is to compare the number of actual combinations of two conditions to the number that would be expected if associations occurred randomly. For example, the expected number of combinations of hypertension and diabetes is the proportion of total deaths with a mention of diabetes times the number of deaths with hypertension mentioned. This is, from Table 9, (3598/48426) x 4285 = 318. In other words, we expect the proportion of hypertension deaths with diabetes mentioned to be the same as the proportion of total deaths with diabetes mentioned. The actual number of combinations, from Table 10, is 776, which results in a ratio of actual to be expected of 2.44. This is statistically significant with a probability of less than .001 based on the chi-square test. We can say that hypertension and diabetes are associated illnesses that appear together much more frequently than would be expected by chance alone.

Table 11 shows combinations of diseases that are highly associated, based on this method. Lung cancer and chronic obstructive lung disease also appear in combination much more frequently than would be expected by chance alone (not shown in Table 11). The high ratio of actual to expected for combinations of alcohol and non-motor-vehicle accidents is due in part to counting code E860 (accidental poisoning by alcohol) as both an accident and alcohol-related condition. Likewise, codes 571.0-571.3 are counted as chronic liver disease/cirrhosis and as an alcohol-related condition. All combinations of heart disease, hypertension, and atherosclerosis and combinations of cerebrovascular disease with hypertension and

Table 11

Pairs of Conditions with a High Ratio
of Actual to Expected Combinations, 1980
(derived from Tables 9 and 10)

		1	4	5	6	7	17	18	19	20	21	22	23	24	25	26
1	Diseases of Heart															
4	Hypertension with or without Renal Disease	*														
5	Cerebrovascular Disease		*													
6	Atherosclerosis	*	*	*												
7	Cancer															
17	Diabetes	*	*	*	*											
18	Pneumonia and Influenza			*												
19	Chronic Obstructive Pulmonary Disease	*			*			*								
20	Chronic Liver Disease and Cirrhosis															
21	Nephritis, Nephrotic Syndrome and Nephrosis						*	*		*						
22	Motor Vehicle Accidents															
23	All Other Accidents															
24	Suicide															
25	Homicide															
26	Alcohol-related Conditions									*		*	*			

NOTE: Associated conditions are shown only in the lower portion of the matrix; the upper-right half would show the same pattern.

atherosclerosis have high ratios, but here also in some cases the same ICD code may be counted in several of these categories (see Appendix 1).
The ratio of actual to expected for almost every condition in combination with motor vehicle accidents, suicide, or homicide is generally below 0.10 since each of these three causes frequently appears alone on the death certificate.

These comments are intended only to highlight patterns found in Tables 7-10, which should serve as a reference source for the reader.

VI. CONCLUSIONS

This report is intended to illustrate some of the uses of multiple conditions death data and to present some baseline statistics for North Carolina. All possible tabulations of the data have not been attempted; however, additional questions can be answered by special request.

One area worthy of future study may be alcohol-related deaths, though underreporting is almost certainly a problem here. Reporting did increase dramatically from 1.9 percent of N.C. deaths in 1969 to 3.1 percent in 1978. Preliminary analysis shows that N.C. nonwhite males have by far the highest number of alcohol mentions per 100,000 population--72 in 1978 compared to 33 for white males, 21 for nonwhite females, and 7 for white females. HSA IV, an area with much in-migration in the 1970's, had an increase of 79 percent in the rate of alcohol mentions from 1969 to 1978. In 1978 in North Carolina, the age groups 55-64 and 45-54 had the highest rates of mention of alcohol with 83 and 67 mentions per 100,000 population, respectively. References (6) and (7) are pertinent studies dealing with alcohol-related deaths.

For more information on multiple conditions present at death and on related topics the reader may consult the bibliography in Appendix 3, which was compiled by the Wisconsin Bureau of Health Statistics and the National Center for Health Statistics.

For questions or comments about this publication, contact Paul A. Buescher, State Center for Health Statistics, at (919) 733-4728, or write to the address on the back of the title page.

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(1) Margaret S. Hollerman, "Multiple Cause Death Data for Wisconsin, 1973-1977," page 43, Bureau of Health Statistics, P.O. Box 309, Madison, Wisconsin 53701.

(2) N. C. Department of Human Resources, Division of Health Services, State Center for Health Statistics, "The Use of Hospital Discharge Data for Estimating Morbidity in North Carolina," SCHS Studies, No. 20, July 1981, page 10.

(3) R.A. Israel, "Analytic Potential for Multiple Cause of Death Data," National Center for Health Statistics, paper presented at the 1981 meeting of the International Epidemiological Association, Edinburgh.

(4) Ronald F. Chamblee and Marshall C. Evans, TRANSAX: The NCHS Multiple Cause of Death Axis Translations System for 1968 - 1978 Data, (draft to be published by the National Center for Health Statistics), November 1981.

(5) U.S. Department of Health Education, and Welfare, Public Health Service, National Center for Health Statistics, Instructions for Medical Classification of Death Records for Automated Classification of Medical Entities, 1976-1977.

(6) Metropolitian Life Insurance Company, "Mortality from Alcoholism," Statistical Bulletin, December 1977.

(7) F.E. Speizer, et al, "The Uses of Multiple Causes of Death Data to Clarify Changing Patterns of Cirrhosis Mortality in Massachusetts," American Journal of Public Health, 1977, volume 57, no. 4.

diagnosis. We feel that the latter figure is much closer to the true number. This difference holds up in 1979, when 14,719 mentions of atherosclerosis were counted from 9th ICD conditions implying atherosclerosis (see codes below). This high number is due in large part to counting code 414.0 (9th Revision "coronary atherosclerosis") as atherosclerosis in 1979, while in 1978 many of these would have been coded 412.3 (part of 8th revision "chronic ischemic heart disease"), few of which had an arteriosclerosis component under the component-coding system. Code 412.3 is counted as arteriosclerosis in Sections III and IV of this report using the 1969 and 1978 TRANSAX data under the 8th Revision. (If one applies the comparability ratio of .76 for "other ischemic heart disease" to the 8th revision (1978) estimate of atherosclerosis of 18,411, the result of 13,992 is close to the 9th revision (1979) figure of 14,719).

The ICD codes that we considered to imply hypertension or atherosclerosis under the 8th and 9th ICD revisions are:

	ICDA-8	ICD-9
Hypertension	400-404,410.0,411.0,412.1, 412.2,413.0,414.0,430.0, 431.0,432.0,433.0,434.0, 435.0,436.0,437.0,438.0	401-405,437.2,642
Atherosclerosis ("arteriosclerosis" under ICDA-8)	403, 404, 412.1-412.4, 424.9,437.9,438.9,440	290.4,414.0,429.2 437.0,440

A death is counted only once as hypertension, for example, even if more than one of the above hypertension codes appear on the certificate. The same death may be counted both as hypertension and arteriosclerosis if a code from each category is on the certificate. There is the possibility of overcounting with this method since every death in each of these categories may not have involved hypertension or arteriosclerosis. But we think that this method of estimation is much better than just counting the explicit

Appendix 1

Counting Hypertension, Arteriosclerosis, and other Conditions with "Components" Coded from the Death Certificate

Under the 8th revision of the International Classification of Diseases, "parenthetical" or "component" coding was included for certain diseases. For example, if hypertensive cardiovascular disease, with code 412.2, were coded from a death certificate, code 401 for hypertension would be added in parentheses to indicate hypertension as a component of the major diagnosis. In this way, one could get a better idea of the prevalence of hypertension by counting 401's on death certificates, both as major diagnoses (explicit codes) and as components. Indeed, this is the way multiple condition counts were obtained in the 1976-1978 editions of Leading Causes of Mortality for some of the causes. These component codes were included for arteriosclerosis, alcoholic conditions, some diabetic conditions, and selected other diseases, as well as for hypertension.

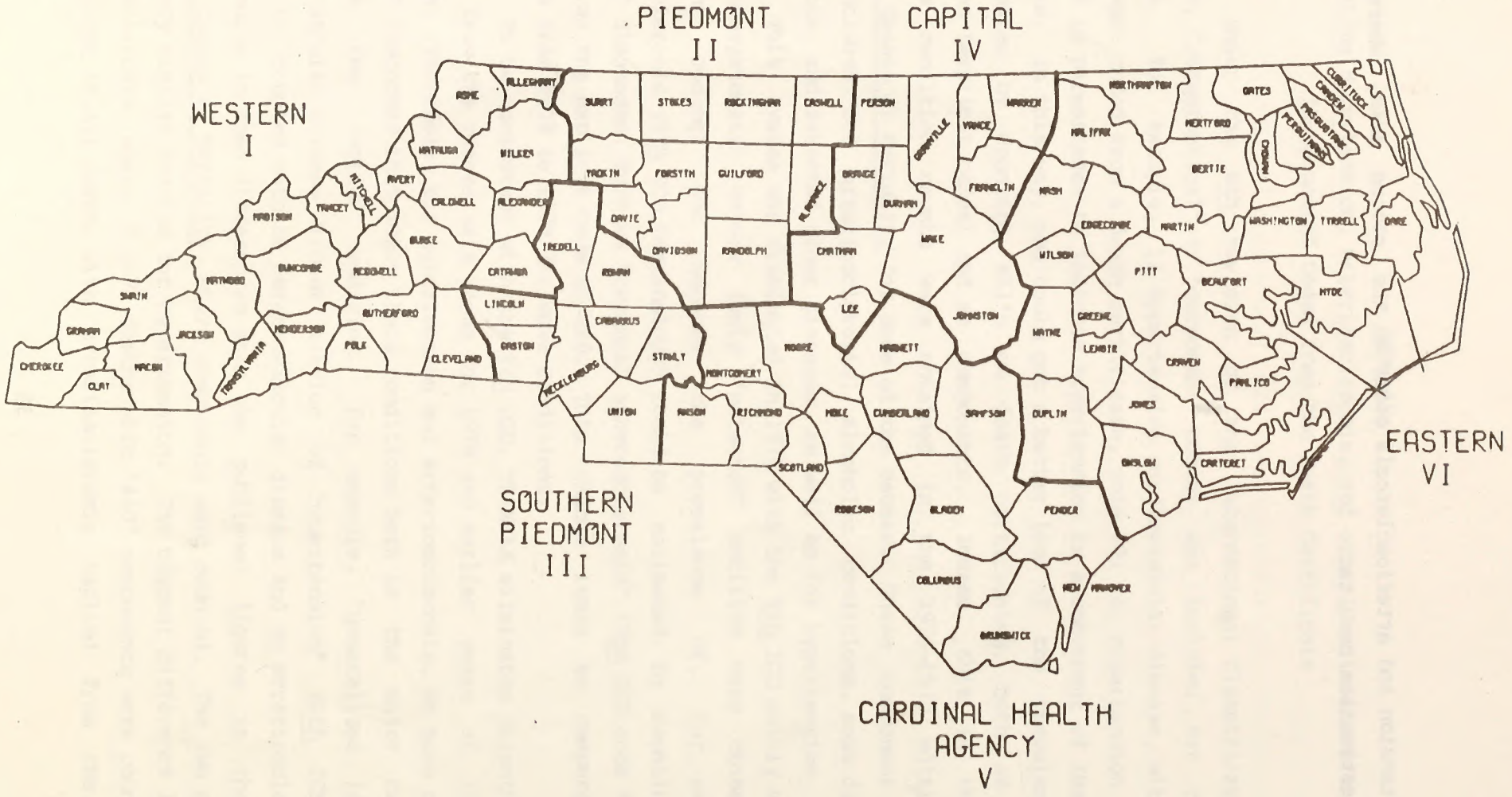
This system was eliminated in 1979 with the 9th ICD mainly because of its nonsystematic nature (only "selected" entities were chosen for component coding) and because the prevalence of, for example, atherosclerosis (9th ICD terminology) could be estimated by counting the "parent" diagnoses, such as "cerebral atherosclerosis" (9th ICD code 437.0), as well as the explicit code of 440. This change leads to comparability problems from 1978 to 1979 for some conditions.

To be consistent with the 9th ICD, TRANSAX eliminates parenthetical entries from the record axis codes for 1978 and earlier years of the 8th revision. Therefore, for hypertension and arteriosclerosis, we have counted "parent" diagnoses that imply these conditions both as the major category and as the implied condition. For example, "generalized ischemic cerebrovascular disease without mention of hypertension" (8th ICD code 437.9) is counted both as cerebrovascular disease and as arteriosclerosis. This results in some differences from the published figures in the 1978 Leading Causes of Mortality, where components were counted. The two methods yield very similar results for hypertension. The biggest difference is for arteriosclerosis where 8,067 deaths with "440" components were counted in 1978, versus 18,411 deaths with arteriosclerosis implied from the major

hypertension and arteriosclerosis codes on the record axis, where severe underestimation results.

Appendix 2

NORTH CAROLINA HEALTH SERVICE AREAS



Appendix 3

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